



ULTRASONIC PHASED ARRAY FLAW DETECTOR

# Sonatest VEO

## Power & performance perfectly packaged.

The **veo** Phased Array ultrasonic flaw detector reinforces Sonatest's reputation for innovative technician focussed product development. The **veo**'s simple controls, superior performance, advanced features and rugged enclosure deliver simplicity, capability and reliability to the technician's finger tips.

Ultrasonic Phased Array technology has become the established method for advanced NDT testing applications. Phased Array techniques allow the user to control parameters such as beam angle and focal distance to create an image of the test part, enhancing defect detection and speed of testing. In addition using the latest computer technology data can be permanently recorded for processing and report generation. The **veo**'s robust design, intuitive user interface and extensive online help brings the power of Phased Array to the field based technician. Typical applications include Weld Inspection, Corrosion Mapping, Aerospace and Composite testing.

## Simplicity

The intuitive menu system is application and workflow driven, with set up and operation swiftly becoming second nature. Integrated Help and Wizards guide the user through scan set up whilst **Optimisation Tips** ensure the **veo** always performs at the highest level. The unique **3D ScanPlan** view gives immediate visual confirmation of correct set up and ultrasound coverage, even in complex multi-probe applications.

Fast and efficient wizards for sound velocity, wedge delay, TCG, DAC, TOFD setup and Encoder calibration are all provided as standard. Clear indication of the calibration status is provided on screen via a simple traffic light system, so that operators can check at a glance that the **veo** is calibrated for the inspection task.

Menu navigation uses Sonatest's second generation scroll wheel technology for fast parameter selection, with shortcut keys for the most used functions and alphanumeric entry. The familiar Start, Stop and Record keys switch quickly between set up, acquisition and recording modes.



16:64 Phased Array

Integrated TOFD

Superior Imaging

Full Data Recording

Fast Encoded Scans

Multi Scan

Simultaneous  
UT & PA

Instant Focal Law  
Calculations

Easy Report  
Generation

IP65 Enclosure

Calibration Wizards

3D ScanPlan

Probe & Wedge  
Databases

TCG and DAC

16 bit architecture

Unlimited Scan  
Lengths

Huge File size (2GB)

USB key  
Data Storage

WheelProbe  
Compatible

Hot Swap  
Battery Packs

[sonatestveo.com](http://sonatestveo.com)

# Capability

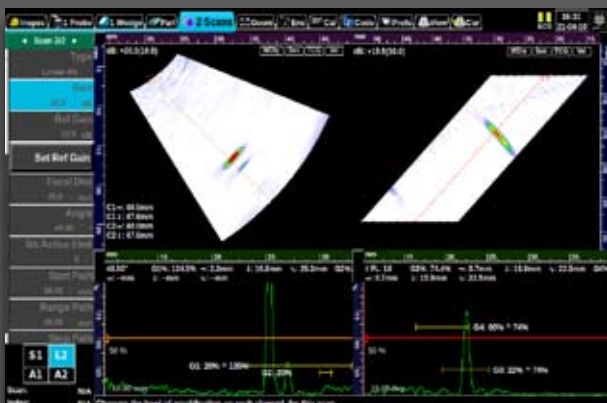
The powerful **veo** platform unlocks a new level of performance in a portable instrument, helping you to maximize your efficiency on-site. The Inspection Plan shows the operator in 2D and 3D where probes are positioned on the test part, simplifying the inspection setup and providing an inspection reference for reporting. All adjustments to focal laws are instantaneous, with angle resolution to  $0.1^\circ$  and up to 1024 focal laws without loss of performance. Multiple scans from different probes may be displayed and evaluated at the same time. Multiple sectorial scans, top, side and end view extractions plus C-Scans are all supported by the veo. TOFD and Phased array inspections can be carried out in tandem at full scanning speed and with up to 2GB data files large areas can be inspected more efficiently. Full resolution waveform data is stored directly to a removable USB data key for ease of back up and transfer to PC.

The **veo** has two dedicated mono element flaw detection channels for conventional UT inspection. Based on Sonatest's Masterscan flaw detectors the channels have 400 V pulsers, Time Corrected Gain and low noise amplifiers, for the most demanding applications.

An impressive hardware specification provides the user with high quality ultrasonic data via a full 16 bit high speed architecture and 12 bit ADC technology whilst digital signal processing based smoothing and averaging enhances image interpretation.

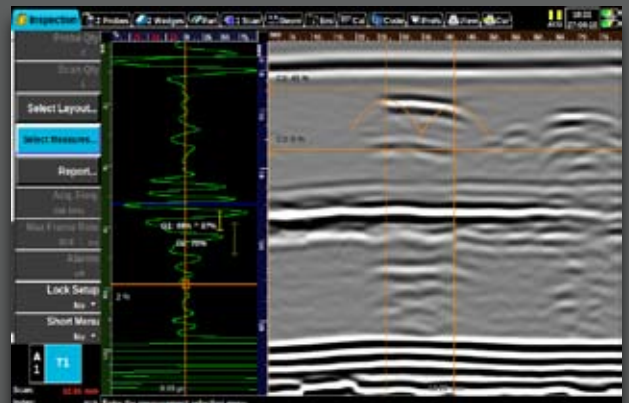
Measurement and sizing of indications can be quickly achieved through the use of advanced measuring tools such as Hyperbolic Cursors for TOFD and Peak Signal measurements from the 2D cursors. Reports can be quickly generated on board and stored as PDFs to the USB data key.

For any flaw detector the display is a crucial element. The Sonatest **veo** has a colour transreflective TFT LCD, providing high visibility in all conditions, with the highest display to size ratio of any field instrument.



## Multi Scans

The **veo** can be quickly configured to display a large range of multi scan views. This allows the user to select the views important for the inspection and to get best use from the display. Sector scan, top, side and end views can all be combined with multiple A-Scan views and TOFD. Cursors and rulers are used to identify indications in the views, whilst measurement tools give size and annotation.



## TOFD

The **veo** has a dedicated analogue architecture for TOFD inspection, using analogue filters developed from the Sonatest range of flaw detectors. Coupled with the lowest noise amplifiers, high speed data acquisition and a high definition display, superior quality TOFD scans can be viewed live at the same time as Phased Array. Phased Array and TOFD inspections can be evaluated together for added confidence during weld inspection. Built in evaluation tools allow quick and accurate evaluation of the TOFD inspection, which can be included in a test report.

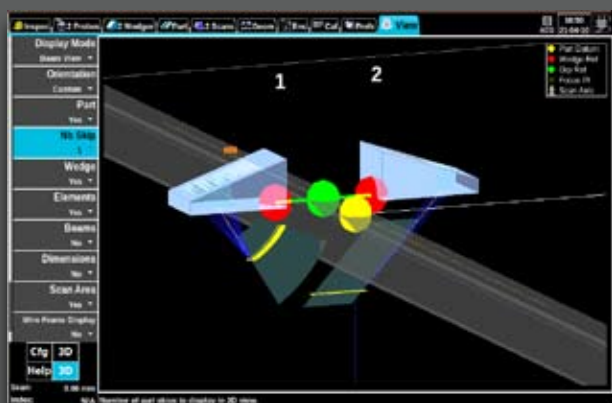
# Reliability

Robust design and proven reliability are essential attributes in demanding NDT environments. Down time is expensive and should be minimized to ensure maximum productivity. Sonatest's reputation for rugged construction and high quality products has been earned over 50 years serving the industry. The **veo** is constructed to exacting standards using a rigid, shock mounted, internal chassis surrounded by an impact absorbing enclosure and sealed to IP65. Designed to incorporate many features to make site work easier the **veo** is fitted with standard camera mount fittings underneath and four attachment points on the back for tripods and other equipment accessories. Additionally the four corner D-rings allow the **veo** to be attached to carry straps and 4 point body harnesses for easy movement and freeing hands for scanning. The **veo** has a two battery design which is "hot swappable", therefore minimising down time and heightening the reliability of performance in the field.

## UT Studio

UT Studio is a PC based software package for Phased Array analysis and report generation. Recorded **veo** data files are easily transferred from the USB data key and used to generate new views and projections. Using a familiar windows drag and drop interface, the user can create multiple views such as Top, End and B-Scan by simply dragging **veo** data files onto templates for display.

Powerful measurement cursors and extractors are used to identify indications, size and annotate defects. Reports are easily generated and can be exported into PDF format for review and circulation.



### 3D Scanplan

The **veo** Scanplan supports multiple probes and scans, enabling the set up of inspection plans from a number of sources quickly and efficiently. Choose from a range of weld geometries and visualise the probes on the part in the locations you choose. Multiple skip paths are shown on the 3D Scanplan allowing the user to ensure coverage for weld inspections. Simple reference points are indicated for easy interpretation and locations of probes on the part can be quickly defined. Mixtures of probe types are supported in pulse echo and pitch and catch: phased array; TOFD or conventional UT. The Scanplan is an invaluable reference for your inspection report, communicating the results of your inspection more clearly, and saved as part of your inspection for future use.



### A-Scan

The **veo** supports traditional ultrasonic testing with mono transducers. The high definition LCD and fast graphics rendering ensure both a high level of accuracy and a fast interactive waveform display. Thanks to the high resolution of the LCD display, measurements are clear and easy to read, and the wide screen format provides a huge viewing area for the scan. The A-Scan display ensures the peak signal is always displayed so that you never miss a defect.



# 16:64 Specifications (specifications are subject to change)

## PHASED ARRAY

|                         |                                                                  |
|-------------------------|------------------------------------------------------------------|
| <b>Pulsers</b>          |                                                                  |
| Configuration           | 16:64 (16 pulser/receivers; driving up to 64 elements)           |
| Test Mode               | Pulse-Echo and Transmit/Receive                                  |
| Transducer Socket       | I-PEX                                                            |
| Pulse Voltage           | -50 V to -100 V (in steps of 10 V)                               |
| Pulse Shape             | Negative square wave (with ActiveEdge)                           |
| Pulse Width             | adjustable 25ns to 1000ns (2.5ns resolution)                     |
| Edge Time               | <10 ns in 50 ohms load                                           |
| Output Impedance        | <16 ohms                                                         |
| Trigger                 |                                                                  |
| Synchronisation         | Encoder or free-running (time based)                             |
| Tx/Rx Focus             |                                                                  |
| Delay Range             | 0 to 10 µs (2.5 ns resolution)                                   |
| <b>Receivers</b>        |                                                                  |
| Gain Range              | 0-84 dB, in steps of 0.1dB                                       |
| Input Impedance         | 50 ohms                                                          |
| Bandwidth               | 200kHz - 27MHz (-3 dB)                                           |
| <b>Data Acquisition</b> |                                                                  |
| Architecture            | Full digital delay and sum architecture                          |
| Digitizing Frequency    | 50/100 MHz                                                       |
| Digitizer Resolution    | 12 bits                                                          |
| Data Processing         | 16 bits/sample                                                   |
| Data Recording          | Full raw data recorded                                           |
| Max A-Scan Length       | 8192 samples<br>(32 metres in steel LW, 50MHz, 1:128)            |
| Maximum PRF             | 20 kHz                                                           |
| Focal Law Qty           | Up to 1024                                                       |
| Focussing Type          | Constant Depth, Constant Sound Path, Constant Offset             |
| Processing              | Smoothing, Averaging, Keep Max, Software Gain                    |
| Filters                 | 7 narrow bands and 3 broadbands, automatic                       |
| Sub-sampling            | 1:1 to 1:128                                                     |
| Rectifier               | RF, Full, Positive, Negative.                                    |
| Reference               | Initial pulse or gate, IFT supported                             |
| <b>Scan &amp; Views</b> |                                                                  |
| Supported Scans         | S-Scan & L-Scan                                                  |
| Real Time Views         | S, L, B, C-Scan, Top and End view.                               |
| Colour Maps             | 8 Standards (Rainbow, Grayscale, Spectrum, Aeronautic or custom) |
| Multi-Group             | Multiple Sector scans and TOFD Scan                              |

## Cursors

|              |                                                |
|--------------|------------------------------------------------|
| Type         | Cartesian, 2D Box, Angular                     |
| Measurements | Path Length, Depth, Surface Distance, DAC, AWS |

## CONVENTIONAL UT/TOFD (MONO ELEMENT CHANNELS)

|                   |                                                                                                                     |
|-------------------|---------------------------------------------------------------------------------------------------------------------|
| <b>Pulsers</b>    |                                                                                                                     |
| No. of Channels   | 2 TX/RX (2 multiplexed channels)<br>2 RX                                                                            |
| Test Mode         | Pulse-Echo, transmit/receive, TOFD                                                                                  |
| Transducer Socket | BNC or LEMO 1 (factory option)                                                                                      |
| Pulse Voltage     | -400 V (adjustable from -100 to -400 V in steps of 10 V)                                                            |
| Pulse Shape       | Negative Square Pulse (with ActiveEdge)                                                                             |
| Pulse Width       | Adjustable from 25 ns to 2000 ns, resolution 2.5 ns                                                                 |
| Edge Time         | <20 ns in 50 ohms load                                                                                              |
| Output Impedance  | <10 ohms                                                                                                            |
| <b>Receivers</b>  |                                                                                                                     |
| Gain Range        | 102 dB (-30 dB to 72 dB)                                                                                            |
| Input Impedance   | 400 ohms                                                                                                            |
| Filter Bands      | Narrow bands centred at 0.5 MHz, 1 MHz, 2.25 MHz<br>5 MHz, 10 MHz and 15 MHz<br>Broadband at 1 MHz to 18 MHz (-6dB) |

## Data Acquisition

|                         |                                             |
|-------------------------|---------------------------------------------|
| Digitizing Frequency    | 50/100/200 MHz                              |
| Digitizer Resolution    | 10 bits/sample                              |
| Data Processing         | 16 bits                                     |
| Data Recording          | Full raw data                               |
| Max. A-Scan Length      | 8192 samples                                |
| Maximum PRF             | 12 kHz                                      |
| Processing              | Smoothing, Filter, Keep max                 |
| Sub-sampling            | 1:1 to 1:128                                |
| Rectifier               | RF, Full, Positive, Negative                |
| Trigger Synchronisation | External digital input, encoder or internal |

## Scans & Views

|                 |                 |
|-----------------|-----------------|
| Supported Scans | A-Scans,        |
| Views           | A, B-Scan, TOFD |

## Cursors

|              |                                                |
|--------------|------------------------------------------------|
| Type         | Cartesian, Hyperbolic                          |
| Measurements | Path Length, Depth, Surface Distance, DAC, AWS |

## CONVENTIONAL AND PHASED ARRAY

|                                  |                                                                                                             |
|----------------------------------|-------------------------------------------------------------------------------------------------------------|
| <b>DAC</b>                       |                                                                                                             |
| Number of Points                 | 16                                                                                                          |
| DAC Quantity                     | 1 with 3 sub-DAC (per focal law in PA)                                                                      |
| <b>Time Corrected Gain (TCG)</b> |                                                                                                             |
| Number of Points                 | 16                                                                                                          |
| Gain Range                       | 0 to 60 dB                                                                                                  |
| Max Gain Slope                   | >50 dB/µs                                                                                                   |
| <b>Gates</b>                     |                                                                                                             |
| A-Scan Gates                     | 4 gates per A-scan (3 extracted A-scans per S/L-scan)                                                       |
| Gate Trigger                     | Flank/Peak                                                                                                  |
| S/L-Scan                         | 2 "2D gates" per S/L-scan                                                                                   |
| Alarm LED                        | 1 (sync on all gates & DACs)                                                                                |
| Measurements                     | Available in A-Scan view<br>1D Peak (FSH, dB, D, BPL, SD)<br>1D Flank (FSH, dB, D, BPL, SD)<br>Echo to Echo |

|            |                                              |
|------------|----------------------------------------------|
| Reporting  | PDF file, PNG screen captures, customer logo |
| PDF Reader | Allows viewing any uploaded PDF document     |

## GENERAL

|                        |                                                                              |
|------------------------|------------------------------------------------------------------------------|
| <b>Data Storage</b>    |                                                                              |
| Internal               | 6 GB (standard)                                                              |
| External               | Hot removable "User" USB 8 GB (standard)<br>Only limited by USB key capacity |
| Transfer Rate          | To User Key - Up to 23 MB/s Write mode<br>Up to 27 MB/s Read mode            |
| Data File size         | 2GB (FAT32 file system)                                                      |
| Typical Scanning Speed | 10 to 15 cm/s (3.9 to 5.9 in/s)                                              |
| Typical Scan Length    | >10 m (32.8ft)                                                               |

|                |                                        |
|----------------|----------------------------------------|
| <b>Display</b> |                                        |
| Size           | 25.9 cm (10.2 in) Wide aspect ratio    |
| Resolution     | 1024 x 600 pixels                      |
| Colour         | 260k (65535 colours for scan palettes) |
| Type           | TFT LCD                                |

## I/O Ports

|              |                                    |
|--------------|------------------------------------|
| USB Ports    | 3 x USB certified ports (480 Mbps) |
| Ethernet     | Gbit Ethernet (1000 Mbps)          |
| Video Output | VGA Analog (1024 x 600)            |

## I/O

|              |                                                                                         |
|--------------|-----------------------------------------------------------------------------------------|
| Encoder      | 1 or 2 axis quadrature encoder (LEMO connectors)<br>Single ended and differential input |
| Power Output | 5 V, 500 mA, current limited                                                            |

|                  |                                                                                         |
|------------------|-----------------------------------------------------------------------------------------|
| Integrated Help  | Active parameter description and Optimisation Tips.                                     |
| Language Support | Six user selectable languages from: English, German, French, Spanish, Russian, Chinese. |

## Batteries & Power Supply

|                     |                                              |
|---------------------|----------------------------------------------|
| Battery Type        | Intelligent Li-ion batteries                 |
| Number of Batteries | 2                                            |
| Operation           | 1 battery or 2 batteries, DC Power pack      |
| Battery Replacement | Hot swappable - no tools required            |
| Battery Recharge    | Batteries recharge in unit, operating or not |
| Battery Life        | 6+ hours (typical operation).                |

## Enclosure

|        |                                                            |
|--------|------------------------------------------------------------|
| Size   | H220 mm x W335 mm x D115 mm (8.66 in x 13.19 in x 4.52 in) |
| Weight | 5.28 kg(11.6 lb) 1 battery/ 5.75 kg (12.6 lb) 2 batteries  |

## Environmental

|                   |                                                                                        |
|-------------------|----------------------------------------------------------------------------------------|
| Temperature       | Operating -10 °C to 40 °C (14 °F -104 °F).<br>Storage -25 °C to 70 °C (-13 °F -158 °F) |
| Relative Humidity | 5 to 95% non-condensing                                                                |
| Environmental     | Meets IP66                                                                             |

|                      |                                                                                |
|----------------------|--------------------------------------------------------------------------------|
| Warranty             | 1 year.                                                                        |
| Calibration Standard | EN12668.                                                                       |
| Vibration            | EN60068-2-6 Sinusoidal vibration, 50hz to 500Hz, 0.5mm, 18g,<br>5 sweep cycles |

## Supported Inspection Codes

### Other relevant Code are also met.

- ASME Code Case 2235-9 Use of Ultrasonic Examination in Lieu of Radiography
- ASME Code Case 2541 Use of Manual Phased Array Ultrasonic Examination Section V ASME
- ASTM E2491 Standard Guide for Evaluating Performance Characteristics of Phased-Array Ultrasonic Examination Instruments and Systems
- ASTM E2700 Standard Practice for Contact Ultrasonic Testing of Welds Using Phased Array
- CEN EN 583-6 - Nondestructive testing - Ultrasonic examination - Part 6 -TOFD as a Method for Defect Detection and Sizing
- BSI BS7706 - Guide to Calibration and Setting-Up of the Ultrasonic TOFD Technique for the Detection, Location, and Sizing of Flaws



Part No; 147395 (Iss 3\_03-11)

# veo Kits & Accessories

## Standard veo Kit

veo 16:64

Calibration Certificate

UT Studio Single user licence

- Conventional Views (A/B/C/D)
- Phased Array Views (S/L-Scan)

• Viewing Reports

USB Memory Stick (8GB)

Lithium-Ion Battery packs x 2

Power Cord & Power Supply adaptor

Couplant

Quick Start Guide & User Manual CD

Screen Protector (Anti-Glare)

Carry Strap

4-point Neck Harness

Transport Case (Airplane carry on size)



## veo Accessories

Splash Proof USB Keyboard

Waterproof Mouse

Battery Charger

Tripod

Lithium-Ion Battery pack

UT Studio - Professional edition

QuickTrace Encoder

Rapidscan to veo Encoder Adapter

DAAH Array probe cable

Screen Protector

USB Memory Stick (8GB)

Phased Array Cable Y-Splitter

TOFD 40 dB Pre-amp

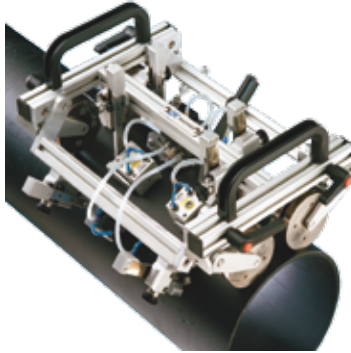
Phased Array Test Block Steel

Phased Array Test Block Aluminium

HD15 Encoder Adapter

## veo Kits

- veo & Magman Scanner
- veo & Corrosion WheelProbe
- veo & Manual TOFD
- veo & Manual Weld



## veo Transducers

Further transducer models available, enquire for full range.

| Frequency (MHz) | Model Number             | No. of Elements | Pitch (mm) | Wedge        |
|-----------------|--------------------------|-----------------|------------|--------------|
| 2.25            | T1-PE-2.25M20E1.2P       | 20              | 1.2        | External     |
| 2.25            | T1-PE-2.25M14E1.2P-35W0D | 14              | 1.2        | 35° Integral |
| 2.25            | T1-PE-2.25M18E1.2P-17W0D | 18              | 1.2        | 17° Integral |
| 5               | T1-PE-5.0M32E0.8P        | 32              | 0.8        | External     |
| 5               | T1-PE-5.0M22E0.8P-35W0D  | 22              | 0.8        | 35° Integral |
| 5               | T1-PE-5.0M26E0.8P-17W0D  | 26              | 0.8        | 17° Integral |
| 7.5             | T1-PE-7.5M44E0.6P        | 44              | 0.6        | External     |
| 7.5             | T1-PE-7.5M30E0.6P-35W0D  | 30              | 0.6        | 35° Integral |
| 7.5             | T1-PE-7.5M40E0.6P-17W0D  | 40              | 0.6        | 17° Integral |
| 5 MHz           | CWP-05-64-08-05-veo      | 64              | 0.8        | WheelProbe   |
| 2 MHz           | CWP-02-64-08-05-veo      | 64              | 0.8        | WheelProbe   |



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